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Worldwide Report

ENVIRONMENTAL QUALITY

No. 225

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BRIEFS

EARTHQUAKE IN KABUL--Kabul, 16 Aug (BAKHTAR)--A relatively severe earthquake rocked Kabul and its vicinity last Tuesday [14 August] evening. The Seismological Centre of Engineering College of Kabul University recorded the earthquake at 6:55 p.m. and 16 seconds with an intensity between 4 to 5 at Richter. The Seismological Centre has shown its epicentre 290 km northeast of Kabul and its depth at 140 km. [Text] [Kabul KABUL TIMES in English 16 Aug 79 p 3 BK]

CSO: 5000

HAZARDS TO CONSERVATION OF BARRIER REEF REVIEWED

Melbourne THE AGE in English 11 Aug 79 p 19

[Article by Vincent Serventy: "Battle for the Reef"]

[Text]

THE Great Barrier Reef may be safe by 2029 — or what's left of it!

The Great Barrier Reef Marine Park Authority Act passed through Federal Parliament in June, 1975.

If we accept that the authority spent its first year in organisation it has still taken four years to have the southern section of the reef declared a marine national park.

This section is 6 per cent of the total area of the reef, which covers 3000 square kilometres stretching 2000 kilometres from north to south.

A marine national park is the ultimate protection since it means no mining, drilling or other directly harmful activities can be carried out.

At this snail-like progress it will be another 50 years before the whole of the Great Barrier Reef will have this measure of safety.

How much of the rest of the reef will be worth saving by the year 2029?

In 1928 a group of British scientists set up a base on Low Islands, offshore from Port Douglas in northern Queensland.

The leader of this group was a young man named Maurice Yonge, who, with his team of 12 biologists, worked steadily for a year studying this wonderland of corals. Their final reports firmly placed our Great Barrier Reef among the natural wonders of the world.

This no-longer young leader, now Sir Maurice Yonge because of his eminence in the scientific field, revisited the Low Islands in 1975 and was deeply distressed by what he saw.

He said it would be impossible to carry out the previous research in the same area today since the reefs and associated corals were now covered with sediment and the once clear waters were cloudy.

This in 50 years with no mining, drilling or oil spills! The destruction had come about because of the rapid development on the nearby mainland, including the clearing of the rainforests which added immense quantities of silt to the loads carried by the rivers.

As well, the increasing use of pesticides and the pouring of these and other waste products into the sea, as though it were an inexhaustible sink, could have produced changes in the complex web of life we call the Great Barrier Reef.

What other problems have beset the reef since 1928?

Shell collecting, from being a minor problem, has increased to become a menace.

This is not only through the greed of commercial operators taking specimens for sale around the world, to satisfy the almost insatiable demand of those who want them as decorative items.

There has also been the exploitation of large molluscs such as the triton and the giant clam. The latter in particular are being stolen by a new breed of sea pirates, operating mainly from Taiwan, and taking the clam only for its muscle, a tender item in its massive flesh.

In the magazine 'Australian Fisheries' of July 1977, R. G. Pearson of the Queensland Fisheries Service estimated that since 1969 at least two million clams had been stolen.

The numbers have increased during the past two years despite all the efforts of the Australian Government to patrol the area. However the Government has not complained to the Taiwanese Government, which licenses the boats. Given the Taiwanese desire to obtain fishing concessions the threat of economic reprisals should be sufficient.

Another disaster which threatened the reef was the invasion by the crown-of-thorns seastar. These creatures feasted on the coral polyps, the major attraction in the marine life. The reasons for the plague and the present position are still a matter of scientific debate.

A continual worry is the possibility of oil tankers being wrecked in the maze of reefs through which they thread their precarious way.

A biologist who has been working in the reef area, Soames Summerhays, told about more damage already done.

Magnetic Island had a thriving coral community 10 years ago. Today it has been destroyed by carelessly dumped spoil from dredges.

Underwater workers have told him that the waters of the newly declared Capricorn Marine National Park are becoming turbid. Fish catches in many parts of the reef have slumped; not only the food fish such as coral trout and potato cod, but also the eagerly

hunted aquarium species such as the blue tang.

What needs to be done to halt the alarming decay of this coral wonderland?

Sir Maurice Yonge restated a theme which has been propounded time and time again by conservationists.

"The Great Barrier Reef is the most important and biggest reef structure in the world," he said. It is a very elaborate and complicated ecological system. No one can predict what could be the results on the reef of a major oil spillage.

"The possibilities are that the whole reef could be killed or that sections of it would be seriously damaged for many years."

The sea has no barriers. Like a stone thrown into a pool, ripples from one disaster can affect the whole system.

The Great Barrier Reef is not only a maze of corals. It is also a legal maze with powers divided between the State and Federal Governments. Recently the Federal Attorney-General, Senator Durack, clearly outlined the legal problems.

Conservationists might like to have the whole of the Great Barrier Reef declared a national park to be managed by a single authority. The legal facts of life, with the State Government having legal title to the land areas and the Federal Government the seas, means it must be managed through co-operation. The pattern for this has been set at Ayers Rock and Kakadu National Parks.

The expertise of the Australian National Park and Wildlife Service will have a strong input in their management, with the Northern Territory service providing the day-to-day administration.

Only the Queensland Government has the power to control what happens on the mainland in terms of cutting silt loads, pesticides and other wastes pouring into the oceans.

Only the State Government has the legal power to control the tourist developments on islands in the reef zone.

Only the Federal Government has the power to control what happens in the sea.

Yet through public opinion polls 66 per cent of the people of Australia have stated that they want no drilling on or near the reef — and that means the total area named in the Great Barrier Reef Marine Park Authority Act.

Even though Queensland still trails the field in conservation, the past few years have seen an upsurge of interest, particularly in the declaration of a number of important new national parks on the mainland.

There is a keen State National Park and Wildlife Service, efficient though small, and needing more money for the number of staff needed for work on the Barrier Reef.

By combining their expertise with the expertise and financial power of the Federal instrumentalities, there is no reason why research and management could not be accelerated so the whole of the Barrier Reef will be saved as part of the world's natural heritage.

Certainly all Australians will hold Senator Durack and his Government to the promise in his statement on the legal position: "We are not talking about giving away the ultimate constitutional power of this Parliament."

When the chips are down, Australians will expect their Government to do its duty.

CSO: 5000

BRIEFS

DARLING RANGE STUDY--The WA Government will set up a group soon to study land use in the Darling Range. The group will operate initially for two years. The move results from recommendations by the Environmental Protection Authority in response to the environmental review and management programme prepared by Alcoa for its alumina refinery at Wagerup. The Premier, Sir Charles Court said last night that the group would report to the Government on land-use policy options. It was envisaged that the group would be headed by a full-time chairman with a research scientist and two land-use analysts. The Government had also established a research coordination committee under the chairmanship of the Conservator of Forests, Mr Bruce Beggs to work closely with the study group. This committee would determine research priorities and coordinate funding. The scope of its activities would extend to research into the effects of clearing native vegetation on water quality, dieback disease, the rehabilitation of forest areas cleared temporarily or affected by disease, and the development of techniques to help in making future land-use decisions. [Excerpts] [Perth THE WEST AUSTRALIAN in English 25 Jul 79 p 9]

ANTISALINITY CAMPAIGN--The [West Australian] State branch of the Country Women's Association will ask the Government to make funds available for speedier and coordinated salt-land research and reclamation. The association wants the Government to do this to show its concern for the problems of salinity. An association spokesman said that country people found salt more devastating and widespread than industrial pollution. It was necessary to coordinate research so that various bodies such as the Department of Agriculture, the CSIRO, the Forests Department and the Public Works Department worked together without overlapping areas of research. At the association's state conference yesterday a delegate from Kojonup said that solutions to salinity problems such as tree-planting, as suggested by the Department of Agriculture, had been unsuccessful. The trees had been destroyed by animals such as kangaroos and sheep. The CWA also agreed to approach the Local Government Association of WA seeking cooperation in guarding against indiscriminate use of weedicides on road verges. [Excerpt] [Perth THE WEST AUSTRALIAN in English 11 Aug 79 p 20]

YARRAMAN SOIL PLAN--The first soil conservation plan for the Yarraman district of the South Burnett, involving 32 porperties and 2700 hectares, was approved by State Cabinet yesterday. The Primary Industries Minister (Mr. Sullivan) said yesterday the plan would control soil erosion. He said Yarraman district farmers were entitled to subsidies up to a $1500 maximum from the Soil Conservation Authority on the cost of on-farm soil conservation works and measures. [Text] [Brisbane THE COURIER-MAIL in English 14 Aug 79 p 12]

WITTENOOM REPRIEVE--Last November the WA Government decided to close Wittenoon for health reasons. It led to a bitter battle with residents determined not to move. Just as the State Government seemed to have weathered the storm of protests it suddenly capitulated. The Minister for Health, Mr Ray Young, in giving the town a reprieve, said the Government would not force people to leave the town. But it is quite obvious that while giving ground the Government is quite unrelenting in its belief that Wittenoon is still a dangerous place in which to live. The WA Government is conscious of the town's heavy reliance on tourism and has stressed there is no danger [from asbestos dust and fibres] to short-term visitors to Wittenoon. But it leaves no doubts as to its thoughts on the dangers confronting anyone who decides to live in Wittenoon permanently. It has announced it will provide assistance until June 30 next year to anyone who wants to leave the town. [Excerpts] [Canberra THE AUSTRALIAN in English 14 Aug 79 p 9]

REEF DRILLING FOR RESEARCH--The Great Barrier Reef is to be drilled- but for research only. The Australian Institute of Marine Sciences director (Mr. J. S. Hunt) said it would be part of a study expected to contribute to a better understanding of the geological and biological origins of the Reef. It was necessary to drill the Reef to reveal strata and recover fossil coral samples for identification and comparison with forms living at the surface. Dr. Hunt said the cores would be of small diameter and recovered from relatively shallow depths. The knowledge was crucial to understanding the dependence of coral reefs on environmental balance. [Excerpts] [Brisbane THE COURIER-MAIL in English 7 Aug 79 p 2]

CSO: 5000

BRIEFS

PESTICIDES KILLING BEES--Indiscriminate and excessive use of pesticides has affected apiculture in India. According to the secretary of the Khadi and Village Industries Commission, production in the major-honey producing states has been hampered because of shorter floral seasons and danger from pesticides which kill bees.--UNI. [Text] [Calcutta THE STATESMAN in English 27 Aug 79 p 9]

CSO: 5000

CITIZENS' FIGHT AGAINST POLLUTION DESCRIBED

Seoul THE KOREA HERALD in English 29 Aug 79 p 4

[Article by Terra A. Anderson: "Japanese Fight Pollution"]

[Text]

TOKYO (AP) — Ten years ago, pollution in Tokyo was so bad that oxygen was sold from tanks on the street. Hundreds of people became ill and many died from chemical poisons. Rivers in many cities were dying.

Now, after spending billions of dollars, Japan hopes that soon its air and water will be as clean and clear as they were 20 years ago.

"The period of serious health damage is past," said Hiraishi Taka of Japan's Environmental Protection Agency. "Now we are working on a new environmental policy for a more comfortable life."

In 1968, Tokyo's air was a thick, brown soup. Thousands of people suffered from painful, bloodshot, swollen eyes because of the sulfuric acid content of the rain. Tokyo Bay was branded the foulest body of water in the country — a smelly, sludge-filled pool in which fishing and bathing were banned.

Tokyo's schools were even forced to move exercise and gymnastics indoors because the playground air was found unfit.

After several disasters, authorities began to take action against the effects of the pollution — mercury poisoning from chemical industry waste, which killed almost 50 persons and left hundreds of others with brain damage or crippled; poisoning by cadmium, zinc and lead from mining wastes that killed 100 and left 1,000 with split bones, deformation and severe pain; Kanemi rice oil disease from PCB (polychlorinate biphenyls) used in processing rice oil, and others.

Finally, Japan decided that kind of price for a booming economy was too much. Beginning in the late 1960s and early 1970s, the government passed some of the strictest antipollution laws in the world, and gradually kept tightening them.

It also budgeted huge sums for environmental improvement, and forced private industry to spend heavy amounts as well. The effort has paid off.

Tokyo Bay once more has a fishing industry. The Sumida River in the capital, once dead and smelly, now is lined with fishermen and pleasure boaters, and a giant salamander, known for its preference for clean water, was caught there last year.

Sulfur oxide and carbon monoxide levels at 95 per cent of the monitoring stations in the city meet air quality standards. Photochemical smog, still a problem, reaches "unhealthful" levels only 15 days a year in Tokyo, in contrast to 328 days in the peak year of 1973.

Toxic and harmful substances have been almost

completely eliminated from Japan's rivers and shores, and at least two rivers in urban areas contain water that is drinkable with only minor treatment. The cost has been enormous. The government budget for pollution control has increased every year for the last 10, reaching more than $5,000 million this fiscal year — 1.6 per cent of the national budget. Local governments spent nearly twice that much in fiscal 1977, the latest figures available.

Private industry spending on antipollution equipment peaked at nearly $4,500 million in 1975 — 17 per cent of total capital investment. Since then, with such equipment already installed at most plants, it has fallen to $1,600 million this fiscal year.

A measure of the progress that effort has brought can be seen in the 73,000 "officially recognized" pollution victims in Japan — that is, those who receive government compensation for their ills. That's up from 35,000 in 1976, but according to the environment protection agency's Taka, only because the government has recognized more pollution victims from old incidents. Nearly all have been ill for years and have just been granted compensation. Few became sick recently.

Japan still has many pollution problems. Three out of eight large rivers in cities, and six out of 10 small ones receive the lowest rating for quality of water — fit only for industrial use.

Sulfur oxide levels in the cities have increased slightly over the past several years because of the increasing amount of traffic.

Because of high costs and local opposition, construction of sewers has lagged. Only slightly more than 20 per cent of the homes in Japan are connected to sewers, compared to 75 per cent in the United States.

The big problem now is noise pollution, receiving half the complaints made by Japanese citizens. Tokyo's transportation system, with eight subways and several railroad lines, may be efficient, but it's also noisy.

"It's a social problem," Taka noted. "It's difficult to control because it's by nature intermittent."

The most significant part of Japan's antipollution effort has been the recent shift from eliminating direct health hazards to what officials call "enhancing the living environment."

Government planning has become more long range, involving such things as the new "total effluent control policy" being expanded from the inland sea to other areas.

CSO: 5000

CRITERIA FOR EVALUATING RADIATION HAZARDS IN NUCLEAR FACILITIES REVIEWED

East Berlin KERNENERGIE in German Vol 22 No 3, Mar 79 pp 94-98
manuscript received 28 Aug 78

[Article by F. W. Krueger, GDR State Bureau for Nuclear Safety and Radiation Protection, East Berlin: "Radiation Hazard and Its Evaluation for Nuclear Facilities." The article is a revision of two lectures presented at the 2d scientific meeting of the GDR Society for Radiation Protection, held in November 1977, and at a colloquium of the III Zittau, May 1978]

[Abstract] The state of the art in the measurement and evaluation of hazards resulting from the operation of nuclear facilities is reviewed on the basis of references in the literature with the aim of establishing the extent to which an assessment of the hazards could contribute to the establishment of protective regulations (for example mandatory safety-prevention equipment such as shielding and decontamination). Economic and statistical methods are widely used to assess the significance of the risks and the cost-effectiveness of proposed measures aimed at reducing the hazards. At the present state of the art, these methods still yield rather uncertain results. However, they do provide a better insight into the causes, probabilities, and consequences of various dangers, as well as into the effectiveness of proposed preventive measures. Since many subjective criteria and assumptions are included in the calculations, the method of cost-effectiveness will not yield entirely objective results. Thus, the measures aimed at reducing the hazards must also consider relevant experience, expert opinions, politico-and socia-economic considerations, and engineering analyses. Conclusions based solely on the latter factors permit objective evaluation of the hazards and their comparison with hazards created by other technological operations. The economic approach should be used for the assessment of the proposals based on these conclusions, rather than for creating the proposals themselves. Summarizations of reports dealing with these matters were presented in the article to demonstrate the validity of the conclusions outlined (such as analysis of radiation deaths, release of radioactive iodine isotope, and cost/experience comparisons). Figures 5; table 1; references 26: 19 Western, 1 German, and 6 Russian.

BEHAVIOR OF A NUCLEAR POWER PLANT IN A LOSS-OF-COOLANT ACCIDENT STUDIED

East Berlin KERNENERGIE in German Vol 22 No 5, May 79 pp 160-164
manuscript received 25 Apr 78

[Article by E. Adam and H. Carl, Dresden Technical University, Energy Conversion Department; and K. Kubis VEB Bruno Leuschner Nuclear Power Plant, Greifswald, Rheinsberg Branch: "Behavior of a Nuclear Power Plant With a Pressurized Water Reactor in a Loss-of-Coolant Accident." This article is a revision of a lecture presented at the 9th Power Plant Engineering Colloquium of Dresden Technical University, 19-20 October 1977, in Dresden]

[Abstract] Accidents in the operation of nuclear power plants in general, and accidents caused as a result of coolant loss in particular, cannot be analyzed in the usual manner, namely evaluation of past accidents. Instead, theoretical considerations and scientific considerations are used to fortell possible accidents so that they can be studied. In a loss-of-coolant accident, the major hazards are release of heat and radioactive materials. For a study of such accidents, the processes taking place in the reactor leading to loss of coolant must be studied. These processes have been extensively discussed in the literature. Once an accident involving coolant loss has occurred, the performance of the containment system becomes very critical. In general a loss-of-collant accident may occur if one or more of the limit values of the following are exceeded: pressure in the system area, pressure in the operating area, coolant content in the volume compensator, pressure in the coolant loop of the reactor, and activity in the safety containment space. Most expected damages occur in the in-pile loop. The accident is usually triggered by breaks in the coolant pipes; secondary difficulties are created by damage in the core. The effectiveness of the emergency cooling system is a critical factor in containing the accident. An analysis of roughly 1,500 operation years of nuclear power plant operation indicates that severe loss-of-coolant accidents should be rare occurrences. The analysis also shows that the theoretical design considerations employed in the designing, building, and operation of a nuclear power plant are on the conservative side, meaning that the

typical nuclear power plant has an adequate safety reserve. Of course, this safety factor increases the downtime of an operating reactor, which in turn represents major economic losses. Overall, the probability of an individual being fatally injured in a loss-of-collant accident is thought to be in the same order of magnitude as the probability of being killed by a meteorite. The study deals pr[illegible]arily with pressurized water reactors. Figures 6; references 15: 12 Ge[illegible]d 3 Western

CSO: 5100

DAMAGE TO STEAM GENERATOR TUBING IN PRESSURIZED WATER REACTORS STUDIED

East Berlin KERNENERGIE in German Vol 22 No 4, Apr 79 pp 118-126
manuscript received 23 May 78

[Article by D. Pastor and K. Oertel, VEB Bruno Leuschner Nuclear Power Plant, Greifswald: "Behavior of Boiler Tubes in Steam Generators of Pressurized Water Reactors (Progress Report)"]

[Abstract] The literature dealing with boiler-tube performance in the steam generators of 26 pressurized water reactors, all of which were started up before 1972, was reviewed. All major reactors of this type now in operation are included in the survey; they employ either vertical U-tube or horizontal single-pot steam generators. The major fault reported was stress-corrosion cracking, primarily encountered in the tube bottom, just above the tube bottom, and in the sharpest tube bends. No fatigue corrosion was observed in the headers; this was attributed to the beneficial effects of the baffling between the tubes (usually made of criss-cross lead strips). It was concluded that corrosion damage occurs most frequently in those areas of the tube bundle where the flow conditions are unfavorable, where bulky deposits may form, and were high fabrication stresses exist. The incidence and/or severity of stress corrosion is attributable to various factors such as the use of not entirely suitable materials of construction (Inconel appears to be the best suited among those encountered) and the water treatment (OH and Cl ions appear to be particularly harmful; phosphate buffering does not constitute adequate protection; the so-called all-volatile treatment [AVT] appears to yield the best results). Especially effective measures in the area of water treatment include those which reduce the formation of porous deposits and sludge, and those which prevent the development of unfavorable flow conditions. The mechanism of stress-corrosion development is thought to be either the formation of so-called dry spots (with cyclic wetting and evaporation processes) or the so-called Macbeth-model process (localized boiling within the pores of a deposite' layer). According to a recent proposal, addition of small quantities of EDTA [ethylenediaminetetraacetic acid] would ensure that only an unsaturated solution of corrosion products and hardness-forming agents circulates within the steam generator, and that--as a result--the tendency of deposit formation is drastically reduced. Figures 3; tables 5; references 54: 19 Western, 1 Bulgarian, 6 Russian, and 28 German.

CSO: 5100

PEACETIME RADIOACTIVE CONTAMINATION, MONITORING SYSTEM DESCRIBED

Warsaw PRZEGLAD OBRONY CYWILNEJ in Polish No 6, Jun 79 pp 29-36

[Article by Mgr Dariusz Grabowski and Dr Eng Silia Jankowska: "Radioactive Contamination of the Environment in Peacetime and a Monitoring System"]

[Text] Everybody is subject to continuous ionizing radiation activity. It has always been so. Cosmic radiation irradiates the Earth's entire surface. Natural radioactive isotopes are found everywhere in man's environment--in soil, rocks, water and air. And natural radioactive isotopes are present in all living organisms, including man. Above all these are potassium-40, carbon-14, radium-226, thorium-232 and their decay products absorbed by organisms in the surrounding environment. These radioactive isotopes constitute a significant share of the irradiation of living organisms. Other radioactive isotopes also occur in nature, but their dosage in man is minimal. All together there are about 40 known naturally occurring radioactive elements.

Cosmic radiation and natural radioactive isotopes are called natural radiation or the natural radiation background.

The magnitude of the natural radiation doses received by people depends on many factors, for example, the latitude, the altitude above sea level, and the geographical structure of a given terrain.

Human activity also affects the distribution of natural radioactive isotopes in the environment. The burning of fossil fuels discharges into the atmosphere significant amounts of radium, thorium and their derivatives that prior to burning were 'trapped' in the coal. Building material produced from an admixture of various types of ashes and slag increase the radiation background in buildings constructed of such material.

On average a resident of Poland annually receives a dose of 100 millirems* of radiation derived from cosmic radiation and natural radioactive isotopes.

*The rem is the unit of radiation dose for a living organism; it specifies the amount of energy transferred to a tissue taking into consideration biological effects that depend on radiation type and sensitivity to irradiation of specific organs (1 millirem = 0.001 rem). In most cases, for beta and gamma radiation, 1 rem = 1 rad.

Table 1. Percentage share of specific types of radioactive fallouts for various kinds of nuclear explosions

1) Rodzaj wybuchu	2) Moc wybuchu				
	3) ponad 1 Mt			4) poniżej 1 Mt	
	5) rodzaj opadu				
	6) lokalny	7) tropo-sferyczny	8) strato-sferyczny	6) lokalny	7) tropo-sferyczny
Powietrzny 9)	—	1	99	—	100
Naziemny 10)	79	1	20	80	20
Nawodny 11)	20	1	79	20	8
Głęboko pod wodą 12)	100	—	—	100	—

Key:

1. Type of explosion
2. Explosion yield
3. Over 1 megaton
4. Less than 1 megaton
5. Type of fallout
6. Local
7. Tropospheric
8. Stratospheric
9. Air
10. Surface
11. Water surface
12. Deep underwater

Particles which reach the stratosphere will remain there for a long time, on the order of years. The tropopause is a barrier to the downward movement of these particles. This creates a reservoir of long-living radioactive substances, primarily strontium-90 and cesium-137, above the tropopause. The tropopause, however, is not an absolute barrier. Its 'leakage' depends on the time of year and latitude. Maximum leakage of dust through the tropopause occurs in the spring.

It is estimated that people now receive on the order of 4 millirems annually over their entire bodies as a result of worldwide radiation fallout.

Some radioactive pollution of the biosphere is caused by experimental and nuclear-power reactors that are now in operation. The radioactive isotopes krypton-85 and tritium have appeared in the environment. However, these isotopes contribute very little to the radiation dose received by people; it is estimated to be about 0.003 percent of the natural radiation dose.

Other operating nuclear centers--research centers, reactor fuel processing plants, and radioactive waste material processing and storage plants--are a source of radiation contamination. Appropriate technology and safety and monitoring systems, under normal circumstances, can prevent radioactive substances from entering the environment. Nuclear centers operating in Poland do not significantly affect the radioactive pollution level of the environment.

Also, the employment of radioactive isotopes by various users for scientific, economic and technical applications will not cause radioactive contamination of the environment if proper technology is used in working

with radiation sources. The unsealed and sealed sources that have been distributed thus far in Poland have not polluted the environment and have an insignificant effect on the population. All types of emergency situations can be potential sources of radiological danger for the environment and population, such as: reactor break-downs, radiation accidents when working with radioactive isotopes, accidents while transporting isotopes, and so forth. Such dangerous situations are taken into account, the extent of their probable effects are evaluated, and appropriate actions are planned. An analysis of possible dangerous situations under Polish conditions shows that the extent of their consequences would be limited to the immediate region surrounding the accident and would not present a significant danger to the population.

Of course, a small group of the population, that is people exposed to radiation on the job, receive doses that are greater than the average for the population, but they are recognized as acceptable. In all countries these people are closely monitored and no symptoms of radiation induced sicknesses are observed in them. In Poland over 95 percent of the monitored individuals receive in the course of a year doses that are less than 0.1 of the largest permissable dose established by international regulations.

It is estimated that the average person in Poland now receives from all sources a dose of about 180 millirems annually over the entire body. Table 2 shows the contribution of various radiation sources to this dose. It should be added here that the maximum permissable dose for average individuals (above the natural background and the dose obtained as a result of medical treatment) is 0.5 rem annually, and for people exposed to radiation on the job it is 5 rems.

Table 2. Approximate average annual dose for individuals in Poland from specific radiation sources

1) Źródło promieniowania	2) Dawka roczna w miliremach
Środowisko 3)	
tło naturalne 4)	100
opad promieniotwórczy 5)	4
energetyka jądrowa 6)	0,003
Zastosowania medyczne 7)	
diagnostyka i terapia 8)	72
rentgenowska 9)	
diagnostyka i terapia radioizotopowa 10)	1
Narażenie zawodowe 11)	1
Przedmioty powszechnego użytku zawierające źródła promieniowania 12)	2
13)	Łącznie: 180

Key:
1. Radiation source
2. Annual dose in millirems
3. Environment
4. Natural background
5. Radioactive fallout
6. Nuclear power industry
7. Medical applications
8. Diagnostics and therapy
9. X-ray
10. Radioisotopes
11. Occupational exposure
12. Common use articles that contain radiation sources
13. Total

The development of atomic physics and the ever increasing use of ionizing radiation and natural radioactive isotopes in science, medicine and the economy as well as their military applications subject the population to increased irradiation.

Undoubtedly, medical applications are the greatest sources of radiation doses, especially X-ray radiation used in diagnostics and therapy, and to a much lesser degree the use of radioactive isotopes is another source. From the viewpoint of potential radiation damage, it is estimated that for the most critical tissues, that is for the gonads and bone marrow, these doses on average amount to 3 to 5 millirems per year and 50 to 100 millirems per year respectively.

One of the primary factors contributing to the radioactive contamination of the environment is experimental nuclear charge explosions. To date nuclear weapons tests have discharged into the biosphere an enormous amount of man-made radioactive isotopes which fall on the Earth as a worldwide radioactive fallout.

The fallout consists of small particles of dust measuring from fractions of a micron to several dozen micrometers which were produced during a nuclear burst, were lifted into the high layers of the atmosphere and which did not immediately descend under the force of gravity as a local fallout after the surface burst.

Worldwide fallout can be divided into tropospheric fallout and stratospheric fallout.** Stratospheric fallout consists of small particles from high-yield bursts in which a cloud of dust enters into the stratosphere, or from high altitude bursts. Tropospheric fallout consists of small dust particles that arise after small-yield bursts or of light dust particles from other types of explosions occurring in the troposphere. The percentage share of specific types of radiation fallouts for various kinds of explosions is shown in Table 1.

Tropospheric fallout propagates rapidly around the Earth's circumference, falling on its surface. Precipitation is a vital factor in removing dust from the troposphere. Radioactive substances remain in the troposphere for about 1 month.

Processes occurring in the atmosphere cause tropospheric fallout to encircle the Earth from west to east; maximum concentration of radioactive substances occurs at the moderate latitudes. The southward propagation of dust is limited.

**The troposphere is the atmosphere layer that extends from about 9 to 14 km, depending on the time of year and latitude. The stratosphere extends above the troposphere. A boundary layer, called the tropopause, separates both layers. Mixing of stratospheric air and troposphere air via the tropopause is limited.

The relatively low current level of radioactive contamination of the environment does not negate the need to systematically monitor these pollutants and to evaluate the degree of danger to the population as a whole. This danger can arise as a result of a nuclear accident in conjunction with the release into the atmosphere of large amounts of radioactive substances, or as a result of nuclear weapons testing or the long-term accumulation of radioactive isotopes released into the environment during normal operations of nuclear equipment. Depending on weather conditions, a large-scale accident, even in a neighboring country, can affect the radioactive pollution situation in Poland. Despite the fact that the probability of such danger is very small, it cannot be completely neglected. Of course, the most threatening radiological danger would be the explosion of nuclear charges on Polish soil or in Europe. In such cases radioactive fallout, even outside the local zone, would increase the pollution level significantly. Determining the results of a nuclear danger ahead of time will permit certain recommendations to be implemented (for example, limiting the consumption of milk) which can significantly decrease the danger to people.

The Radiation Contamination Measurements Service [SPSP], which was created by the Councils of Ministers Resolution No 265/64 of 29 August 1964 and is overseered by the Ministry of Power Industry and Atomic Energy, monitors radioactive contamination levels in Poland. SPSP's organization is based on using research and monitoring stations belonging to various ministries as measuring stations. Presently, SPSP encompasses 110 measuring stations, including stations associated with the Institute of Meteorology and Water Management, Voivodship Sanitary-Epidemiology Stations, Environmental Research and Control Stations, Chemical-Agricultural Stations, Veterinary Hygiene Institutes, institutions of the Milk Industry Institute, specialized institutions and scientific research institutes.

These measuring stations are subordinate to their institutions and ministries, but their activities in the area of monitoring radioactive contamination is directed and coordinated with regard to organization, scope and methodology of measurements by the Main Center for Radioactive Contamination Measurements [COPSP]. The Central Laboratory for Radiological Protection, which is also SPSP's scientific research base, performs COPSP's functions.

Measurements encompass the air, total fallout, atmospheric fallout, surface water, municipal water, sewage, soil, plants, agricultural-food articles, and food products, domestic as well as imported.

Monitoring contamination levels is based primarily on measurements of total beta activity according to a standard measuring method.

The total beta activity measurements results are encumbered with errors resulting from the fact that, in addition to the activity of man-made radioactive isotopes, the activity of natural radioactive isotopes, mainly

potassium-40, affects results. However, for heavy contaminations the measurement results for total beta activity can be the basis for approximate levels of contamination if the average value of potassium in the test samples is taken into account.

For milk, the cesium-137, strontium-90 and iodine-131 contamination levels are monitored. Milk contamination can be treated as an index of diet contamination.

Measurements of air contamination and total fallout are the most sensitive and realizable measurements, providing quick information about a sudden increase in contamination caused by a large-scale nuclear threat. They are performed daily at several dozen points in Poland. In addition, continuous air contamination measurements are conducted at several points in Poland. The results of these measurements also permit the tracking of contamination caused by worldwide radioactive fallout as a result of nuclear test explosions.

Monitoring to date indicates that there has been no sudden change in contamination levels in Poland that would cause a state of alarm. The maximum contamination of the air and total fallout occurred in 1962-1963, during the period of intensive nuclear weapons testing. At that time the average annual beta contamination for Poland was about 3 pCi/m^3 for air and about 1,000 mCi/km^2 for fallout. In the years that followed, contamination gradually decreased so that in 1967 it was 0.08 pCi/m^3 for air and 32 mCi/km^2 for total fallout. During the next two years, contamination resulting from explosions, mainly Chinese and French, was about double (see Figure 1). There was no ascertainable difference in the level of air contamination in Poland. In the case of total fallout, the level of contamination is higher in the zone encompassing central Poland, proceeding from the northeast to the southwest. The difference, however, does not significantly affect the dose received by the population from worldwide fallout.

The measuring stations also monitor areas around nuclear centers. Additional collection stations are located around such centers (to sample soil, plants, sewage and surface water).

The purpose of the conducted measurements is to investigate the effect of these centers on the environment. There was no significant contamination of the surrounding areas by radioactive isotopes. In those centers that represent the greatest potential danger (the reactor at the Nuclear Research Institute, plants that reprocess and use highly active unsealed sources), the contamination of the surrounding areas from gases and sewage is also monitored continuously.

Figure 1. Chart of air contamination and total fallout occurring in Poland from 1961 to 1977

Key:
1. Air
2. Total fallout
3. Total fallout activity in mCi/km^2 per year
4. Average air activity in pCi/m^3

The work of the measuring stations should assure the execution of two basic tasks:

Quick detection of radiation danger in emergency situations and evaluating the extent of the danger;

Specialized measurements of radioactive contamination of the environment and using these measurements to evaluate the degree of danger to the population.

The first of these tasks in SPSP's amended current activity program is realized via continuous measurements of radiation dose strengths, air contamination, total fallout and atmospheric fallout, by rapid radiometric measurements of samples of components of the environment and food products, and by the rapid designation of iodine-131 in these samples.

To realize the second task, environment samples and test materials will be systematically collected during various parts of the year and their content of selected radioactive isotopes will be determined.

SPSP's activity program must be flexible so that special measurement programs can be conducted in special situations.

To conduct the required measurements, the ZAJK-1 measuring-monitoring equipment was developed and manufactured (see Photo). This equipment permits continuous measurements of gamma radiation dose strength from the natural background level of 0.01 mR/h to 100 R/h. The magnitude of radioactive beta and gamma contamination for any given sample can also be determined in the laboratory with this equipment. This equipment features automatic range change-over, chart recording capability, and an alarm that sounds when a selected threshold of dose strength has been exceeded.

Photo. The ZAPKS-1 measuring-monitoring equipment

The SPSP monitors radioactive contamination and evaluates radiation danger to the environment and population in peacetime. In case of war, these same tasks will be performed, among others by a contamination detection system

organized for such a period. Organizational and technical preparations as well as training personnel for these tasks should be realized in peacetime. The inclusion of the SPSP in realizing these tasks can facilitate the preparation of the system for wartime.

SPSP facility work crews can consist of a consultant group of voivodship civil defense organs that are responsible for problems concerning essential matters related to monitoring contamination and evaluating radiation danger.

SPSP workers are a special group of people having access to large sources of data on radiological protection. SPSP's personnel should be used in the training process conducted by the civil defense and civil defense training centers as well as in other defense training courses. During the normalization of life period after an conceivable war, SPSP's institutions will become the base for conducting technical and research work aiming to eliminate radiological effects as rapidly as possible. Then, when accurate measurements of contamination of the environment, agricultural-food products and food products become necessary, the stations will return to their peacetime pursuits.

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DROUGHT FORCES EVACUATION OF GAME RESERVE RESIDENTS

Gaborone DAILY NEWS in English 20 Jul 79 p 1

[Article by Gale Bareeleng]

[Text]

A serious food and water scarcity has forced residents of drought striken Central Kgalagadi Game Reserve to evacuate.

Residents of Menatshe, Ghiko, Metseamanong, Xhoxwe, Xhotom and Molapo have been moved to Xale and other areas where water is available.

A team consisting of officers from the Remote Area Dwellers' Scheme in Ghanzi, a team from the Central District led by Mr. M. Tshwenegae and the Daily News team in Ghanzi, launched a joint effort to evacuate the residents.

The throes of drought have hit the area so hard that wild vegetables and fruits like 'Motsla' and 'Mokoto' including edible roots have dried up completely.

According to Remote Area Dwellers' Officer, Mr Sobiem Mayane, the World Food Programme has promised to ration food supplies but not on a regular basis.

He said he had sent a radio message about the serious situation to the Ministry of Local Government and Lands and that this is to be followed by a full report later.

Mr Mayane further stated that in order to evacuate people from other drought stricken areas, he would have to summon help from other districts.

A major problem of the area is that transport and communication facilities are poor and as a result, relief, even if promptly solicited would take a long time to reach the people.

While it is too early to predict that famine is inevitable in this area, the situation is compounded by the refusal of some residents, especially elderly people, to move to areas where there are water points.

Some say they prefer to remain on their ancestoral grounds. Others argue that even if they are moved to places where water was available, this would not solve their problem because there are no wild roots and vegetables which are their staple food in these areas.

It would be unfortunate if the World Food Progamme and other relief organisations do not help stave off the severe situation that threatens to engulf the whole Central Kgalagadi area.

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REPORTAGE ON IMPACT OF DROUGHT

Swedish Aid

Gaborone DAILY NEWS in English 24 Aug 79 p 1

[Text]

A P1 million agreement "catastrophe aid" agreement was signed yesterday between Botswana and Sweden. The signing was done by His Honour the Vice President and Minister of Finance and Development Planning Dr Q.K.J. Masire and the Director-General of the Swedish International Development Authority (SIDA).

The Vice President and Mr Forsee also held discussions on matters of mutual-interest between Botswana and Sweden.

The P1 million grant is in response to an appeal by His Excellency the President Sir Seretse Khama to the international community to help Botswana fight the impending drought catastrophe. Sir Seretse Khama made this appeal when he declared Botswana a drought-striken country with effect from June 1 this year.

In his nation-wide broadcast, the President also appealed to Batswana to co-operate fully with the Government in its efforts to combat the drought problem.

Before meeting Dr Masire yesterday, Mr Forsse had on Tuesday met with Honourable Ministers Dr Gaositwe Chiepe, Archie Mogwe and Lemme Makgekgenene. He also met with the Director of Economic Affairs Mr Kenneth Matambo and the Consultant for Evaluations of Livestock Project 1 Dr Maricia Odell.

Mr Forsse was yesterday expected to leave Gaborone for Maun, where he will visit projects. He would later go to Tshane and Hukuntsi before leaving Botswana on Tuesday.

The P1 million grant is one of the generous aid given to Botswana by the Royal Swedish Government. Since January Swedish aid to Botswana has amounted to P13 million. And at present there are about 10 volunteers and 32 experts from Sweden working in various Government ministries and department.

Since the declaration of Botswana as a drought-striken country, and the fresh foot and mouth outbreak, several sweeping and extensive measures to deal with this most difficult period in the history of Botswana, have been adopted.

During the last session of Parliament which ended last week, the vice President reiterated these measures. They range from food relief in the form of increased supplementary ration for children under five years and other vulnerable groups to subsidised seeds to be sold to farmers.

Dr Masire told Parliament that some 100 000 people and 400 000 cattle had been adversely affected by the drought and fresh outbreak of foot and mouth.

Water Crisis Hits

By Botswelelo Tlale

Two primary schools in Taupye and Bonwapitse villages in Central District may not re-open next term because of a water shortage crisis. The crisis has also brought development to a standstill.

According to the chairman of Taupye Village Development Committee Mr Otswakae Tiroyamodimo, some sandwells which were dug in the Taupye River have dried up. As a result there is nowhere to get water for domestic purposes and to water livestock.

He said of the six sandwells, four have completly dried up, leaving only two which are serving the residents. He said if both the Central District Council and Government cannot help alleviate the situation, there is likelihood that the schools could not re-open.

He said the water crisis has led to an accident in which a seven-year old schoolgirl was almost covered by sand in a five foot deep sandwell while trying to fetch water. She was rescued by other people who heard her faint screams for help. She was treated and discharged at Taupye healthpost.

Mr Tiroyamodimo expressed fear for more such accidents occurring if the crisis is not solved soon.

Mr Tiroyamodimo further said that most of the residents have left their homes to settle at Tidi cattle posts. These are about 18 kilometres east of Taupe and there is more water.

Taupye has a borehole but does not operate because it is awaiting an engine to be installed.

The same problem of water shortage has hit Bonwapitse village, about 20 kilometres west of Mahalapye. The headteacher for the local primary school Miss L.K. Masimega explained that some parents have decided to transfer their children to Mahalapye where there is enough water. Some people have actually levt school to go ans stay in Mahalapye too.

Residents of Bonwapitse get water from Mahalapye, but describe this as burdensome. They say they are compelled to pay 50 Thebe for every 10-litre container by transport owners.

The chairman of Bonwapitse Village Development Committee Mr Joseph Setemere has said because of this worsening situation, they have raised P400 and have decided to appeal to the Central District Council to help them drill a borehole. He however, did not disclose whether the Ngwato Land Board has allocated them a site for the purpose.

The Councillor for Mahalapye North Mr G.G. Ngakayagae, in an interview with the Daily News, said the Council is holding discussions about the water problem with the Department of Water Affairs.

He said villages in the Council plan which were to be given top priority for provision of boreholes are Nata, Marapong and Bonwapitse. But the Council was compelled to include Taupye and Kudumatswe in its list.

Mr Ngakayagae said he also shares the view that if the water problem is not solved soon, the Bonwapitse and Taupye primary schools may not be re-opened next term. He said he will remind the Council about the worsening situation.

Rakops, Letlhakane Worst Hit

Gaborone DAILY NEWS in English 30 Aug 79 p 3

[Article by Andrew Sesinyi]

[Text] **As the drought period stretches into the next summer season, and windy hopes seize the nation, the scars of the drought speak of the stranglehold.**

Around Orapa, Letlhakane, worse of all, Rakops (Tsienyane), miles of a wide expanse of land with barely a plant, scorches flimsy white soils, and dry winds blowing clounds of dust into the clear skies, bear testimony to the disaster which has befallen the country.

At Rakops, Wildbeast, (gnu) pay frequent visits to the villages, and residents believe the animals are in search of something to eat.

Ironically driving along the flooded Boteti River, one sees several carcasses of wildbeasts, believed to have died from drought effects. The many remaining are roaming the bare lands, like scarecrows, carrying on the semblance of that proud family of trolicking wildbeast.

Yet there is so much death in this family of animals which is believed to be less resistant to drought conditions, that concerned people fear they might soon be reaching extinction proportions.

Rakops is almost cut-off from civilization'.. or from the rest of the world. The only links with other areas like Maun, or Orapa (the nearest big areas)) are bumpy, twisting roads, tracks in fact, that would not welcome a truck classified as under 60 per cent roadworthy.

Although some government officials visit the village most of the visitors to Rakops seem to be wildbeast. And when more than one vehicle passes through the village, they cause a sensation.

There is what one may describe as quite a cordial relationship these days between the residents and the animals. But people cannot just kill the animals for food because the law prohibits killing of animals without permit.

For the Rakops people, the drought problem was bad. But with the fresh outbreak of foot and mouth disease, the situation is now catastrophic. The small village is now burdened with boundaries controlling cattle movement, and they should continue into the second season now without revenue from cattle sales.

As if that is not suffice, the Boteti River sandwiches the village and its surrounding areas, cutting residents from vital amenities such as the main school and the clinic.

Most of these problems were narrated to His Excellency the President Sir Seretse Khama during his visit there recently, in tones heavily laden with feeling. Ministers, members of Parliament and Government officials are told of these problems too when they visist Rakops.

The fields exhibit the agricultural frustration of Rakops Residents. There are small gardens along the Boteti River. They are bare with the out-growth murdered during its embryonic stage by the dry winds, and lack of rain. After ploughing, the soil looks like a compound of boulders. The soft sand, mixed with clay soil by the river side, shows a muddy concoction of frustrated efforts.

There is no irrigation attempt to draw the water from the river to the fields.

Then the Rakops suffer yet another handicap. A news black-out. With their communication problems, they cannot receive the Daily News. Residents find it difficult to tune Radio Botswana. Instead, they listen to the Rhodesian and South African stations so much that some of them claim they can understand some of the languages used in the radio broadcasts.

A few kilometres from Orapa, one gets to Letlhakane. Almost the same situation prevails here, except that being along the busy Orapa Francistown Road, Letlhakane residents have less transport problems. And with the discovery of diamonds in the area, the village is likely to burn shiny bright in a few years.

But the soil is tragic. It is the same flimsy, desert soil.

The contrast from Rakops, through Orapa and Letlhakane and to Francistown is stunning. What a sharp contrast!

Cloud-Seeding Talks

Gaborone DAILY NEWS in English 3 Sep 79 p 1

[Text]

Batswana might not only be informed of a drought in advance, but could also be assured of reliable water supply during droughts, if the Government yields practically to the Water Utilities Corporation appeals for undertaking a national study of the scientific and legal implications of rainfall stimulation by cloud seeding.

According to the Corporations ninth annual report for the year ending March this year, although the Government had accepted in principle to do this long ago no firm action has so far been taken. But the Corporation has renewed its appeals. And it hopes that action will result before it is too late to plan the activity properly in advance of another drought cycle.

The report states that a feature of the Botswana climate is that length droughts occur periodically. It adds that with dam sources on non-perennial rivers that have their safe yield rated at the high risk of failure for once in 20 years (for economic reasons), "this is rather disquietening."

On evaporation control measures, the report states that the Corporation believes that their are unlikely to produce worthwhile benefits, except in particular circumstances likely to arise when a reservior is within a year or so of source failure.

However, although experiments were carried out by the Government on the Shashe Dam in 1973, the Corporation believes that further experiments utilising the latest techinques would be justified on the Gaborone Dam. This could well have unique features calling for special attention. It has added a request for this work to its latest reminder on the need for a rainfall stimulation study," states the report.

Commenting on the raising of the Gaborone Dam wall, the report states that even after this has been done, the Dam will have a limited period of adequacy if water demand continues to grow rapidly. In answer to this likelihood the Corporation's consulting engineers have identified further dam sites for future exploitation.

Dealing with the water tariff, the report says that as the Broadhurst development is increasing intermittedly the Corporations Loan Debt , it currently seems inevitable that a relatively modest tariff increase will have to be introduced at the beginning of the 1980/81 financial year. The last increase tariff increase was in April 1977.

On the Corporation's staff position, the report states that permanent establishment is 94, 5 per cent is localised. However, it adds that further localisation will be a relatively slow process due to the absence of suitably qualified Batswana for the professional posts particularly civil engineers. The other problem is the lack of qualified people for training in sub-professional careers.

The report states that the Corporations next finacial objective is to build up its surplus to the level needed to ensure that it can finance the renewal of its assets when they are life-expired (particularly the short-to medium assets).

It also wants to contribute towards the cost of primary-assets development in order that it can reduce its level of borrowing and at the same time enhance its ability to borrow by being able to provide its own counterpart financing.

The report deals with Corporation's achivements, problems and future development projects.

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FOOD DELIVERED TO KGATLENG DROUGHT VICTIMS

Gaborone DAILY NEWS in English 31 Jul 79 p 3

[Text]

The Remote Areas Development Officer in Mochudi Mr S. Mfolwe recently dispatched 114 bags of milk and 13 boxes of clothing materials to over 200 people reported to be badly affected by the drought situation at four villages in the north western part of the Kgatleng District. These villages are Dikgonnye, Khurutshe, Bodunwane and Kgomodintshaba.

The dispatch of food and clothing to the villages followed Mr Mfolwe's visit to the area to assess the drought situation. During the visit, Mr Mfolwe identified that the residents of the villages, who seem to have been worst affected by the drought are predominently Basarwa.

Mr Mfolwe explained that fire had scourched large chunks of the area. An acute water shortage problem was also reported. The water problem was aggravated by the fact that wild fruits which help residents in difficult times like Morama, Marekhu, Motsotsojane and Mogwana were destroyed by fire.

It is also reported that development projects like the construction of family welfare educators are progressing at snail pace in some of these villages. And there is poor attendance to adult literacy classes because people are busy searching for some alternative source of food in order to survive.

Mr Mfolwe has explained that reports about the drought situation in the area have been sent to the drought office in Gaborone, as well as other offices which are concerned, in order that additional relief measures could be undertaken to alleviate the situation.

Some of them are reported to be neardboys who had not yet had thier supplies of food from their 'masters'. Some 'masters' supply food to these herdboys in a form of payment.

CSO: 5000

FISH RETURNING TO CLEANER DURBAN HARBOR

Pretoria SOUTH AFRICAN DIGEST in English 10 Aug 79 p 18

[Text] Durban Bay is now cleaner than it has been for 20 years and fish are streaming back in their thousands, according to anglers who once lamented the virtual "death" of the bay after pollution had driven out the marine life.

The *Sunday Tribune* reports it has been due to the efforts of pollution vigilantes and bay officials who, in recent years, have kept a close watch on ships and nearby industries which have polluted the waters indiscriminately.

Mr Jimmy Hindman, chairman of the Natal Angling Board of Control, said the increase in fish life in the bay in the last two years had been remarkable. Gamefish like garrick were streaming in now — "a sight we haven't seen for many years."

He said that during the 1950s fishing in the bay had been perfect but it had then died down. But now, with the new pollution regulations, the demise of the mailships and the system of keeping big tankers out of the bay, fish life had returned.

Durban's harbour pollution officer, Mr Keith Plummer, said Durban was now an oil port and there would always be leakages, blown joints and hose failures. The bay would never return to its prewar state, crawling with thousands of sea life species.

"Then we had the mangrove swamps, the bird sanctuary and the fish-breeding grounds," he said. "But we are living in the oil age, not the coal age like we used to, and that's the reality we have to accept."

CSO: 5000

BRIEFS

PLANS TO COMBAT OIL POLLUTION--Plans to zone South Africa's coastline and draw up contingency plans to fight oil pollution in each zone, are being compiled by the Central Oil Pollution Co-ordinating Committee. The chairman, Mr M G Lotter, of the Department of Transport, said the country should be properly prepared, organised and equipped because of the heavy coastal tanker traffic. The provincial administrations of the Cape and Natal, the Railways, the oil industry, local authorities and other bodies, including wildlife organisations, will help. [Text] [Pretoria SOUTH AFRICAN DIGEST in English 10 Aug 79 p 19]

CSO: 5000

FISH INDUSTRY EFFORTS TO REDUCE POLLUTION

Moscow RYBNOYE KHOZYAYSTVO in Russian No 6, Jun 79 pp 5-6

[Text] Every step necessary is being taken in the USSR to protect the land and its minerals, the plant and animal world, air and water quality, to use them in an intelligent, scientifically substantiated manner, to ensure that this wealth is renewed, and to improve the environment.

In December 1978, the CPSU Central Committee and USSR Council of Ministers adopted a decree "On Additional Steps to Strengthen Environmental Protection and Improve Natural Resources Use." Given the present level of industry development, the atmosphere, seas, rivers and other bodies of water contain many pollutants, which has an unfavorable effect on the environment and damages agriculture, fisheries and forests.

USSR ministries and departments, organizations, institutions and enterprises bear full responsibility for protecting the environment, using it intelligently, and taking environmental protection measures promptly. Ministries and departments are obligated to ensure the development and introduction of apparatus and equipment which will facilitate reducing pollution to minimum permissible values.

The CPSU Central Committee and USSR Council of Ministers decree sets the USSR Academy of Sciences and branch institutes diverse tasks: low-waste technologies must be developed and introduced, along with systems for processing, purifying and disposing of production, municipal-services and household wastes with a view towards reducing discharges of pollutants into the environment to the established norms; appropriate monitoring devices must be created and introduced.

Ministries, departments and enterprise leaders are called upon to concern themselves with implementing scientists' proposals as quickly as possible.

The USSR Ministry of Reclamation and Water Management and the USSR Ministry of Power and Electrification, jointly with the USSR Ministry of Fish Industry, must develop and manufacture prototype highly efficient barriers for water supply installations.

By order of V. M. Kamentsev, USSR Minister of the Fish Industry, it has been suggested that all-union fishing industry associations, enterprises and organizations constantly monitor the prompt implementation of measures outlined in the decrees of directive organs and in orders of the USSR Ministry of the Fish Industry to avoid polluting the environment on ships and at enterprises of the fish industry.

With a view towards further expanding environmental protection measures, schedules for implementing a complex of measures to stop all discharges of unpurified water into the Baltic, Black and Azov seas at enterprises and organizations of the USSR Ministry of the Fish Industry must be made more precise as quickly as possible.

Scientific research institutes are working out normative materials for designing purification facilities and draft norms for maximum discharges of pollutants into the environment. Generalization of the recommendations of scientific research institutes on fully utilizing fish processing scraps collected at fish-processing enterprises, fish oil and bulk fat collected at purification facilities must be completed in the near future.

In summing up the results of socialist competition among subordinate enterprises and organizations, their fulfillment of environmental protection plans and measures, and observance of the norms and rules for using natural resources and for cleaning and processing production wastes must be taken into account. Party and trade-union organizations are faced with generalizing and making accessible to all the best experience, with approaching expansion of the competition creatively.

Branch institutes of the USSR Ministry of the Fish Industry, jointly with organizations of the USSR Ministry of Water Management and the USSR Ministry of Power and Electrification, must participate in working out effective fish-protection installations for water supply facilities with high flow rates and in conducting biological-technical research after they have been built and set up for operation in order to reveal the most promising structures for standard planning.

In order to avoid negative consequences of work done on reservoirs and in coastal zones, we plan to develop maximum allowable concentration norms for ground pollutants.

We anticipate developing recommendations on stopping the discharge of unpurified waste water into natural reservoirs for fish industry enterprises and production facilities which pollute the environment most.

Plans for building and renovating fish industry enterprises must ensure the extensive use of low-waste technology, return water supply, closed-drainage sewage systems, and other progressive methods of protecting the environment from pollution.

A structural subdivision for environmental protection and the efficient use of natural resources will be created in the USSR Ministry of the Fish Industry apparatus.

The USSR Ministry of the Fish Industry coordination group on preventing reservoir pollution and the scientific-technical council will review each year questions connected with the effectiveness of gas-purification and dust-removal installations and of water purification facilities being used at our enterprises and in the fishing fleet.

11052
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IRKUTSK-CHEREMKHOVO MANUFACTURING PLANT SITE ALTERNATIVES

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR; SERIYA OBSHCHESTVENNYKH NAUK in Russian No 1, Jan 79 pp 49-57

[Article by O. P. Burmatova: "Considering Environmental Protection Requirements When Optimizing the Spatial Structure of TPK's"]

[Text] The task of optimizing the spatial structure of an industrial complex with consideration of environmental protection requirements has been resolved using materials on the Irkutsk-Cheremkhovo TPK [territorial-production complex]. The task required that a plan be found for siting manufacturing facilities and distributing the population and basic production infrastructure elements, variants of the best use of natural and labor resources, and measures necessary to protect and renew the natural environment while minimizing aggregate calculated expenditures on developing and operating the elements of the complex of the economy being examined.

In order to reflect the ecological consequences of economic activity within the TPK, an additional block of conditions anticipating observance of the requirements of protecting and renewing the natural environment[1] is introduced into the model of the spatial structure of the complex.[2] Introduction of these conditions permits recording ecological factors while examining questions of the spatial organization of the TPK economy.

The task model includes the following conditions: 1) mandatory creation of each of the assigned objects of branch specialization in one possible site of the complex; 2) restricting construction base capacity and the orientation

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1. O. P. Burmatova, "Natural Environment Protection and Renewal in TPK Models," in IZV. SIB. OTD. AN SSSR; SER. OBSHCHESTV. NAUK, ed. 1, No 1, 1977, pp 33-40.

2. V. S. Zverev and M. A. Malinovskaya, "TPK Spatial Structure Model," in the book "Modelirovaniye formirovaniya territorial'no-proizvodstvennykh kompleksov" [Simulating the Formation of Territorial-Production Complexes], Novosibirsk, Nauka Izd-vo, 1976, pp 158-173.

of the distribution of their output; 3) providing sites with labor resources and restricting the local labor resources reserve; 4) using land resources for industrial and civil construction and restrictions on the extent of possible land use; 5) distributing water among consumers and restricting the amount of water consumption, 6) restrictions on the intensiveness with which purification facilities are operated; 7) waste generation and distribution; 8) restrictions on emissions of environmental pollutants (by individual ingredient and by combination of ingredients); 9) banning the siting of specific combinations of polluting facilities at particular places, and 10) observing specific relationships among polluted discharges from enterprises on a single river.

The Irkutsk-Cheremkhovo TPK is among the few Siberian complexes which is already basically formed and whose territory is characterized by a rather strained ecological situation. In preparing the initial information to resolve the task within the framework of this complex, five possible sites for nine industrial enterprises, two construction bases and five water supplies were delineated (Table 1), allowing for the creation of a number of facilities to purify industrial and household discharges into the air and water.

Table 1. Possible New Enterprise Sites on Irkutsk-Cheremkhovo TPK Territory

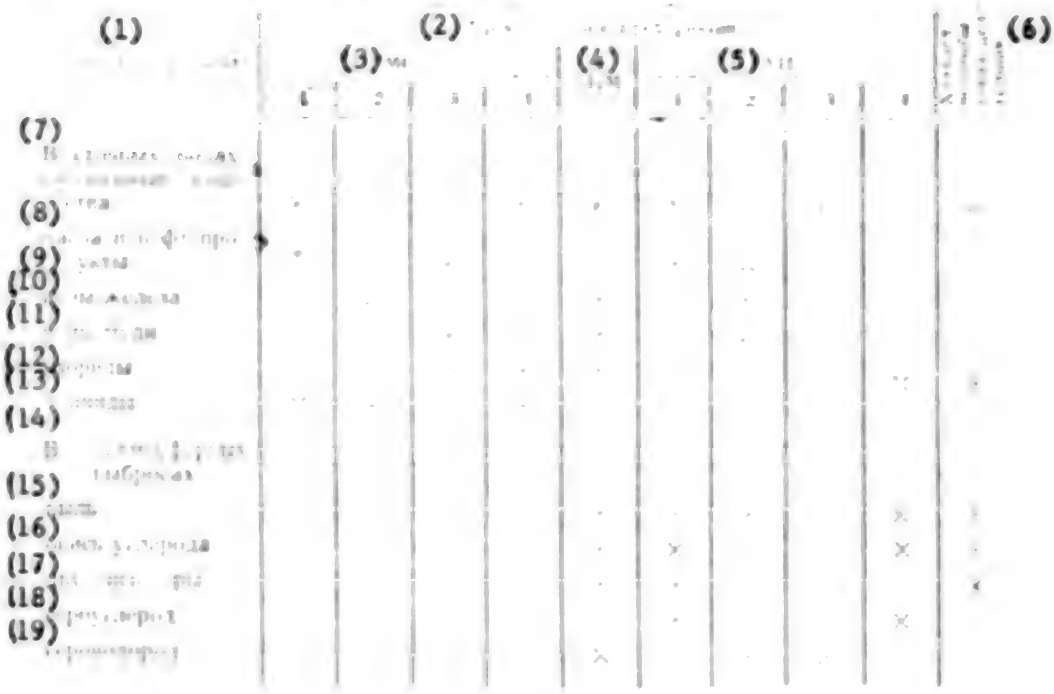
site	MS1	MS2	MS3	MS4	TsM	KhP1	KhP2	KhP3	KhP4
Irkutsk		x	x						
Cheremkhovo	x	x	x	x	x	x	x		
Balagansk	x	x	x	x		x	x	x	x
Zima					x	x	x	x	x
Tulun	x	x	x	x	x	x	x	x	x

Note: MS -- machine building; TsM -- nonferrous metallurgy; KhP -- chemical industry

The restrictions dictated by the necessity of protecting the environment affect not only the economic structure of a given territory and the production technology and its distribution, but also economic indicators. Environmental protection measures (be they waste-free or low-waste technologies, construction of purification facilities, and so on) are generally capital intensive. Therefore, each variant of environmental protection measures proposed must be economically substantiated. The minimum expenditures which will ensure that the assigned ecological standards will be met can be considered a criterion of the effectiveness of the choice of such variants. This requirement was solidly inserted in the target function structure adopted as the optimality criterion when optimizing TPK operation and representing the minimum aggregate calculated expenditures on developing and operating elements of the complex.

All the facilities being examined in the task discharge impurities into the air and water. The basic types of pollutants in industrial and household discharges in our example are suspended substances, oils, iron and copper

Table 2. Pollutant Sources in Waste Water and Discharges Into the Air



Key:

1. Basic ingredient
2. Industrial enterprises
3. MS
4. TsM
5. KhP
6. Household wastes
7. In waste water:
8. Suspended particles
9. Oils and petroleum products
10. Iron ions
11. Copper ions
12. Chlorides
13. Cyanides
14. In discharges into the air
15. Dust
16. Carbon monoxide
17. Sulfur dioxide
18. Carbon disulfide
19. Hydrogen sulfide

ions, chlorides and cyanides. The basic air pollutants are dust, carbon monoxide, sulfur dioxide, carbon disulfide and hydrogen sulfide. Table 2 gives the waste water and atmospheric discharges compositions of the pollution sources being examined. The data from the Table permit describing each type of activity from the viewpoint of the qualitative composition of discharges into the air and water and relating each of the delineated basic waste water and atmospheric discharge ingredients to a specific source of a given type of pollution.

Sewage (industrial and household) generally contains a whole series of different harmful substances which pollute reservoirs simultaneously. Each pollutant has its own harmful effects, but the simultaneous presence of different harmful substances in the sewage of any given branch of industry determines what is in a majority of instances the complex and varied nature of their effect on reservoirs. Thus, the discharge of untreated machine-building

enterprise waste water can lead to the formation of mineral bottom deposits, to the alteration of normal water reaction, to an oxygen deficit, to the formation of a ferrous film on reservoir surfaces, to the suppression of water plant growth, to the destruction of fish, and so on.

It is also important to study the structure of atmospheric discharges in order to delineate first of all the most hazardous pollutants and to anticipate steps to eliminate their negative effects (for example, the negative effect of sulfur gas is several-fold greater than that of carbon monoxide).

Possible industrial enterprise sites are selected (see Table 1) first of all with consideration of the industry concentration which has already evolved within the complex and with consideration of the present status of individual parts of the environment.[1] The sites being examined have been combined into four categories of territories based on ecological conditions. Natural environment protection and renewal tasks have been set for each category.

The first category includes the Irkutsk site. Its territory is characterized by quite a high concentration of industry (chemical, metallurgical, electric power engineering, machine building, and others), with large amounts of harmful discharges into the air and water. Moreover, certain natural-climatic features of this site considerably complicate what is already quite a strained environmental pollution situation. (For example, temperature inversions during the period of frequently repeating calms here cause stagnation of the cold air masses in the Angara River valley and keep the wind from dispersing discharges; there are frequent, persistent fogs which can become toxic when saturated with hazardous discharges.) The site adjoins the site of the Irkutsk water reservoir, which is considered a very attractive site for setting up recreational zones due to its ultraviolet radiation, microclimatic conditions and picturesque terrain; that in turn makes great demands on water and air purity. Therefore, taking into account the local ecological conditions of the Irkutsk site, as well as the favorable prerequisites for developing worker recreation sites outside the city, the task conditions here anticipate limited development of new production facilities with harmful wastes (see Table 1). In accordance with this, the given site is viewed as a territory for the possible siting of two machine-building facilities (MS2 and MS3) with comparatively low amounts of discharges and producing no air pollution.

The Cheremkhovo site forms the second category. It is also distinguished by quite a high concentration of industrial enterprises and population (although to a lesser extent than the Irkutsk site). The basic source of environmental pollution here is the coal industry. Basically the same features of climate influencing pollution intensiveness are characteristic of the Cheremkhovo site as for the Irkutsk site (the same prevailing winds, terrain, and so forth). In particular, toxic aerosols can be formed here.

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1. "Irkutsko-Cheremkhovskiy promyshlennyy rayon" [Irkutsk-Cheremkhovo Industrial Region], Irkutsk, 1969, 240 pages.

Local weather conditions of the Cheremkhovo site limit to a significant degree further industry growth through the creation of new "dirty" facilities. Under the conditions of the task, the territory of this site can be used as possible sites for machine-building enterprises, a metallurgical facility and two chemical production facilities, KhP1 and KhP2 (see Table 1). In this regard, if water consumers are located within the Cheremkhovo site the following condition must be met. The water source and discharge point at the Cheremkhovo site is the Belaya River, which flows into the Angara. In accordance with this, industrial and household sewage from the Belaya (as a result of natural movement) reaches the Angara and can be moved downriver to the Balagansk site, which uses Angara water for industrial and household water supplies. It is about 35-40 km from the Cheremkhovo to the Balagansk site (by river). It is therefore necessary that the relationship between Cheremkhovo and Balagansk waste water discharged be such that the permissible pollution of the Belaya by industry and the populace at the Cheremkhovo site be not greater than the permissible pollution of the Angara in the vicinity of the Balagansk site.

Zima includes the third site category. Here, a large electrochemical combine has already developed and could be a base for further development of the chemical industry. The present level of air and water pollution is insignificant. Local weather conditions are favorable for dispersing discharges into the air and for decomposition of pollutants in the Oka River. The task has been set up for the Zima site to permit siting metallurgical and all chemical production facilities (see Table 1). But in this regard, for two chemical enterprises (KhP1 and KhP3) whose discharges might interact synergistically, the condition is introduced that both these pollutant sources not be located within the same site.

The fourth group of sites is at Balagansk and Tulun. These are sites thus far little utilized and causing practically no environmental pollution. Conditions are favorable for the dispersal of water and air discharges at these sites. Under the terms of the task, the Balagansk site is viewed as a possible site for each of the delineated production facilities except for the metallurgical (TsM), and the Tulun site for all the delineated facilities (see Table 1). A ban on locating the two chemical production facilities at the same site (KhP1 and KhP3) has also been anticipated for both sites.

Several task resolution variants were drawn up. The initial variant was one which does not consider the environmental protection requirements described. Then various environmental protection conditions were systematically added to this variant so as to reveal the impact of each of them on the results of optimizing the spatial structure of the Irkutsk-Cheremkhovo TPK. And the final resolution variant included all the conditions introduced in the aggregate.

The charts of delineated production facility siting on Irkutsk-Cheremkhovo TPK territory obtained as a result of resolving the series of task variants are given in Table 3. Variant I does not anticipate consideration of environmental protection requirements in an explicit form. In the optimum plan

Enterprise Distribution Chart, By Territory Site, for Various Task Resolution Variants

	I					II					III				
(2) Предприятия	(a) Иркутский	(b) Черемховский	(c) Балаганский	(d) Зимский	(e) Тулунский	(a) Иркутский	(b) Черемховский	(c) Балаганский	(d) Зимский	(e) Тулунский	(a) Иркутский	(b) Черемховский	(c) Балаганский	(d) Зимский	(e) Тулунский
(3) MS1		1	X		X		1					0,6	0,4*		
(4) MS2	1	X	X		X	1					1				
(5) MS3	1	X	X		X	1					1				
(6) MS4		1	X		X		1					1			
(7) ЦМ		1		X	X				1*					1*	
(8) ХП1			X	1	X			1*					1*		
(9) ХП2		1	X	X	X		1					1			
(10) ХП3			X	1	X				1				0,4*	0,6	
(11) ХП4			X	1	X				1					1	

	IV					V					VI					VII				
	(a) Иркутский	(b) Черемховский	(c) Балаганский	(d) Зимский	(e) Тулунский	(a) Иркутский	(b) Черемховский	(c) Балаганский	(d) Зимский	(e) Тулунский	(a) Иркутский	(b) Черемховский	(c) Балаганский	(d) Зимский	(e) Тулунский	(a) Иркутский	(b) Черемховский	(c) Балаганский	(d) Зимский	(e) Тулунский
(3)		0,3	0,7*				0,4			0,6*					1		1			
(4)	1					1					1					1				
(5)			0,6*		0,4*					1					1					1*
(6)		1					1					1					1			
(7)				1*					0,7*	0,3*				0,7*	0,3*					1*
(8)			1*					1*					1*					1*		
(9)		1					1					1							1*	
(10)			0,5*	0,5					1					1					1	
(11)				1				1*					1*					1*		

Key:

(1.) [across, within each variant:]
- a. Irkutsk
- b. Cheremkhovo
- c. Balagansk
- d. Zima
- e. Tulun

2. Enterprises
3. MS1
4. MS2
5. MS3
6. MS4
7. TsM
8. KhP1
9. KhP2
10. KhP3
11. KhP4

Note: Figures reflect intensiveness of enterprise operation, by variant; X -- possible enterprise sites. Asterisks note changes in production facility siting given different resolution variants than variant I.

corresponding to this task variant, the new enterprise sites were Irkutsk, Cheremkhovo and Zima (three of the five possible), and each of them is characterized by quite a high territorial concentration of new production facilities.

The siting of machine-building facilities at the Irkutsk and Cheremkhovo sites was determined primarily by the availability here of quite significant labor resources reserves. The way the task is set up, the TsM enterprise is material-intensive and its being sited in Cheremkhovo is influenced not only by the proximity to raw material, but also by the high level of utilization of the territory and development of an infrastructure. The demands this enterprise makes on local resources are insignificant. The Cheremkhovo site also turns out to be preferable for locating the KhP2 facility: cost indicators are best here. The KhP3 enterprise is characterized by high capital-intensiveness and high consumption of electric power, water and labor resources; it will require large construction sites if located here. The possibility of locating the KhP3 at the Balagansk, Zima and Tulun sites was examined. The Zima site turned out to be most favorable, as it is characterized by proximity to a raw material base and the availability of considerable land resources. Facility KhP1 is technologically linked to enterprise KhP3 and also requires a comparatively large site and a great deal of water, which determined the choice of Zima for the site of this particular enterprise. Proximity of raw material played the decisive role in locating the material-intensive KhP4 production facility at this same site.

The industrial production facility siting chart obtained for variant I could lead to overloading the territories of individual sites with new facilities with significant discharges into the air and water. Thus, in the optimum plan the Cheremkhovo site acquires two "harmful" facilities (besides the two machine-building facilities) and the Zima site three. Although there are adequate local natural resources (land and water) for such concentrations within the corresponding sites, we must verify that such concentration will not lead to violation of the established environmental quality levels.

Let us examine how the production facility siting chart obtained (variant I) changes with consideration of particular environmental protection conditions. Let's introduce into the task a condition anticipating considering water consumption to dilute industrial and household sewage being discharged into the reservoirs (variant II). This factor influences the siting of two facilities -- KhP1 and TsM. The KhP1 consumes the most water of all the production facilities delineated, has a high level of waste water, and requires a 20-fold dilution of that waste water. In this connection, Balagansk becomes the most preferable for this particular facility (Zima in the initial variant). The Balagansk site water supply source is the Bratsk reservoir and, under the terms of the task, no restrictions are made here on potential water consumption.

In variant I, the TsM production facility is located at the Cheremkhovo site, and in variant II, at the Zima site. This is to be explained by the fact

that, first, the KhP1 water-intensive production facility has left the Zima site and in so doing has freed considerable water resources for other use, and second, by the lower expenditures on organizing water supplies in the Zima site as compared with the Cheremkhovo site.

Let us draw up variant III, adding to variant II restrictions on the permissible level of basin air and water pollution as a result of production activity. Such restrictions are set up for each site (for atmospheric pollutants) or reservoir (for water pollutants) by individual type of pollutant and by combination of pollutants. In our task, the environmental pollution level is determined by maximum allowable concentration (PDK) indicators for pollutants, which are restrictions on harmful discharges in the model.

As compared with variant II, consideration of restrictions on pollution results in specific changes in siting the facilities being examined (see Table 3, variant III). Thus, some of the MS1 and KhP3 plants shift from their previous sites (Irkutsk and Zima, respectively) to the Balagansk site -- both with a 0.4 intensiveness of operation (the full capacity of each facility is taken as 1).

Similarly to the restrictions in variant III on the permissible level of industrial pollution, the way the task is set in variant IV examines restrictions on environmental pollution by household wastes. The introduction of such conditions leads to change in the siting (as compared with variant III) of facility MS3 and a portion of plant MS1. Consideration of water pollution in the form of household sewage places stricter restrictions on possible pollutant discharges. As a result, the Irkutsk and Cheremkhovo sites threaten pollution above the established norms. In this connection, the MS3 facility leaves the Irkutsk site for the Balagansk and Tulun sites, with 0.6 and 0.4 intensiveness of operation, respectively. And the MS1 facility, with a 0.3 intensiveness of operation, shifts from the Cheremkhovo site to the Balagansk site. The remaining changes obtained in the IV optimum plan result from moving the MS3 and MS1 facilities.

Task variant V is set up on the base of variant IV by introducing a ban on locating combinations of pollutant sources in individual sites. In our example, such bans apply to the simultaneous location of chemical industry enterprises KhP1 and KhP3. As a result, the KhP3 facility moves from the Balagansk site to the Zima site. However, the necessity of observing restrictions on pollutant discharges in this site determines a reduction of discharges into the environment here by moving plant KhP4 from here to the Balagansk site and a portion of the TsM plant, with a 0.3 intensiveness of operation, to the Tulun site. In turn, locating the KhP4 facility at the Balagansk site necessitates moving the MS3 and MS1 facilities from there to the Tulun site.

Variant VI differs from variant V by the observance of specific relationships between pollutants discharged into the water at the Cheremkhovo and Balagansk sites. Introduction of this condition leads to the following change in siting production facilities in the optimum plan: the MS1 facility moves from the Cheremkhovo site to the Tulun site at full capacity.

Two machine-building enterprises (MS1 and MS3) are thus selected for the Tulun site. This is determined by the lower potential use level of water here and by the higher (than at the other sites) expenditures on organizing water supply and discharge, which makes this site unattractive as a location for water-intensive production facilities.

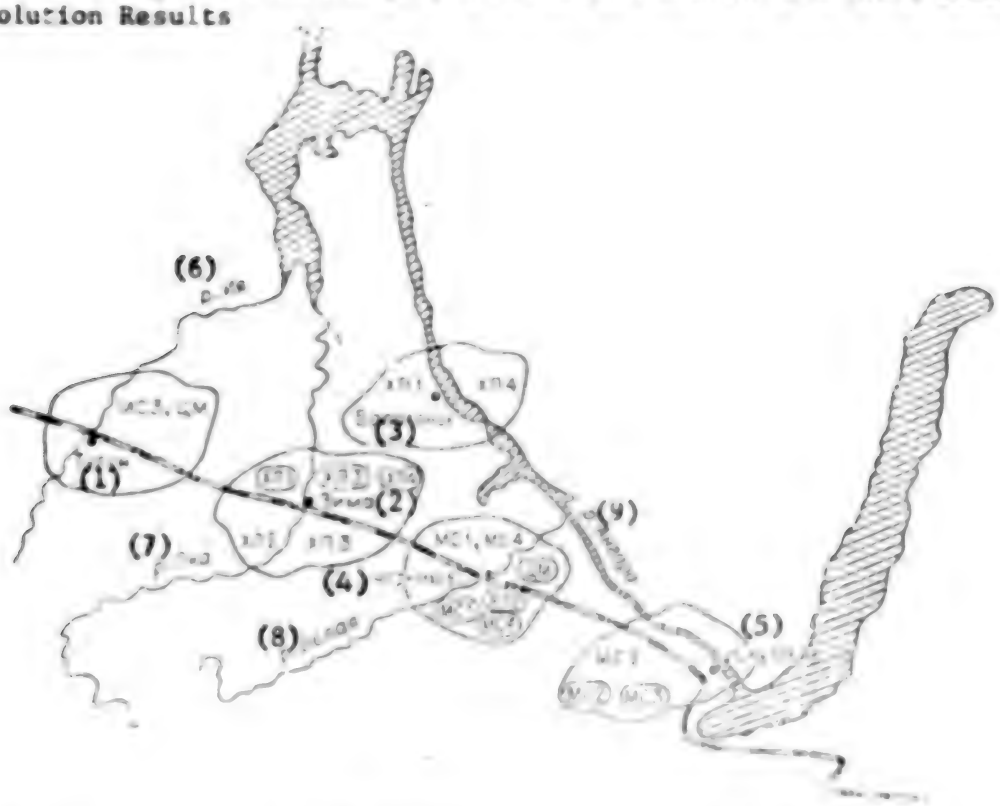
Although environmental pollution occurs in practice as a result of the combined effect of several harmful substances, consideration must also be given to limiting discharges of individual types of pollutants, especially when investigating the effect of toxic ingredients or ingredients discharged into the environment in large amounts. In this connection, variant VII was drawn up by adding to variant VI restrictions on the discharge of combinations of pollutants in industrial and household sewage. Given such restrictions, the possibility of polluting the water basin at the Cheremkhovo site is reduced, as a result of which polluter-enterprise KhP2 leaves this site for the Zima site. However, locating a new enterprise with harmful discharges here leads to a situation in which the TsM facility moves from the Zima site (0.7 intensiveness) to the Tulun site when at full capacity. This in turn results in enterprise MS1's leaving the Tulun site for the Cheremkhovo site. This shift becomes possible as a result of the fact that production facility KhP2, with its significant amount of sewage and concentrations of harmful substances in that sewage, has left the Cheremkhovo site. In so doing, the ecological restrictions are substantially weakened and the given site becomes the most preferred for locating enterprise MS1.

The drawing [page following] illustrates the results of task resolutions without consideration of the entire complex of environmental protection conditions (variant I) and with such consideration (variant VII).

As a whole, consideration of the interrelationships of developing productive forces with requirements for protecting the environment of the individual TPK can, as we see, have a substantial influence on the choice of an optimum variant of the complex's spatial structure. Experimental calculations permit revealing new ways of improving the spatial structure of the Irkutsk-Cheremkhovo TPK with consideration of ecological requirements. From the viewpoint of environmental protection conditions, this particular complex has opportunities available to it for further developing productive forces. However, these opportunities differ substantially by site of the complex, foremost as a function of the level of economic utilization of the site territory and of local natural conditions which determine the ability of the environment to purify itself. From these viewpoints, the ecological opportunities are most limited at the Irkutsk and Cheremkhovo sites and most favorable at the Balagansk and Tulun sites. Given this viewpoint of meeting environmental protection requirements, all the delineated specialized-branch enterprises could be located within the complex being examined.

Moreover, the results of an analysis of the resolutions obtained shows that consideration of environmental protection requirements leads to the most even distribution of production facilities and population throughout the complex: in the optimum plan, all five delineated sites are included, each

Production Facility Distribution, by Irkutsk-Cheremkhovo TPK Site, Based on Task Resolution Results



Key:

1. Tulun	4. Cheremkhovo	7. Oka River
2. Zima	5. Irkutsk	8. Belaya River
3. Balagansk	6. Iya River	9. Angara River

Note: MS, TsM, KhP not circled -- with consideration of environmental protection requirements (variant VII)
MS, TsM, KhP circled -- no consideration of environmental protection requirements (variant I)

of which has one to two production facilities (see drawing). As compared with the initial task variant, the new production facilities have left primarily the Irkutsk and Cheremkhovo sites, where local ecological conditions for locating enterprises with harmful wastes are most strained. Moving the new industrial production facilities to the western portion of the complex and locating them in portions of the TPK less saturated with industry will facilitate decentralizing pollutant sources in the southeastern portion of the complex being examined and creating favorable living conditions there from an environmental point of view.

(Institute of Industrial Production Organization and Economics, Siberian Division of the USSR Academy of Sciences, Novosibirsk)

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CEMENT PLANT DUST-REDUCTION TECHNOLOGY

Leningrad TSEMENT in Russian No 4 1979 pp 4-5

[Article by "Proletariy" cement plant engineers A. Ya. Andreyev and A. S. Gavrilov, NIPIOTstrom: "Unused Reserves for Reducing Dust at Cement Plants"]

[Text] As the cement industry has developed and as the capacity of the enterprises and the basic technological units has increased, protecting the air around cement plants and adjacent residential areas from dust pollution and reducing the amount of dust in the air in individual workplaces have assumed increasing importance.

The primary sources of finely dispersed dust in the shops are belt and bucket conveyor pouring devices, elevator discharge hoppers, places where dusty materials are loaded into hoppers, silos, rail cars, and so forth.

Dust is generated by:
inadequate sealing of equipment and pouring facility housings;
material dropping from great heights during pouring;
inefficient or no aspiration where bulk materials drop;
open transport of dusty materials at high speed, and so on.

Dusty air negatively affects labor productivity, causes occupational disease and accidents, and accelerates equipment wear.

Table 1 [page following] shows the results of a check of air dust in workplaces of six wet- and dry-production cement plants.

It follows from the table that the dust in the air at workplaces of the indicated enterprises exceeds the sanitary norms in a number of cases. The higher dust concentration is to be explained by the absence of aspiration equipment and housings, lack of shop ventilation, unsatisfactory maintenance of technological equipment, and so on. But in premises housing control panels and equipped with air conditioning or securely sealed door and window openings, the dust concentration is within the sanitary norms.

Equipment operation standards play a basic role in combatting dust. For example, at the "Oktyabr'" plant, the dust in the section where raw material

Table 1

(1) Место отбора проб воздуха	(2) Концентрация пыли на рабочих местах, мг/м³ воздуха					
	(3) при мокром способе производства по заводам				(4) при сухом способе производства по заводам	
	(5) «Пролетарий»	(6) «Октябрь»	(7) «Гигант»	(8) Душанбинский	(9) «Первомайский»	(10) Слантсевский
(11) Узел разгрузки щековой дробилки	25	24	244	305	71	—
Узел перегрузки сырья (12) транспортера на трех сборку	23	37	309	86	—	—
Помещение пульта управления печами (13)	5	1,8	1	67	6	3
Площадка головки печей (14)	4	3,5	48	86	15	13
Помещение пульта управления цементными мельницами	2	5,0	46	77	1	16
Узел загрузки цементных мельниц (15)	144	139,3	25	80	250	32
Узел разгрузки цементных мельниц (16)	28	107,4	11	115	—	6
Кабина грейферщика (17)						
склада сырья (18)	17	11,6	4	31	7	20
склада клинкера (19)	9	88,9	130	94	3	83

Key:

1. Air sample taken from
2. Dust concentration at the workplace, in mg/m^3 of air
3. Wet method of production, by plant
4. Dry method, by plant
5. "Proletariy"
6. "Oktyabr'"
7. "Gigant"
8. Dushanbe
9. "Pervomayskiy"
10. Slantsevskiy
11. Jawbreaker unloading point
12. Point where raw material is switched from one conveyor to another
13. Furnace control panel room
14. Furnace ports
15. Place where cement mills are charged
16. Place where cement mills discharge
17. Clamshell crane cab:
18. Raw material yard
19. Clinker yard

is discharged from the jawbreaker is 24 mg/m^3, while it is 12.7-fold higher at the Dushanbe plant; dust in the rotary furnace control panel room at the "Gigant" plant is 0.7 mg/m^3, and at the Dushanbe plant -- 67-fold higher; dust is 3.5 mg/m^3 at the rotary furnace ports of the "Oktyabr'" plant and 24.6-fold higher at the Dushanbe plant; and dust is 2 mg/m^3 in the "Proletariy" cement mill control panel room, but is 38.5-fold higher at the Dushanbe plant.

Dust at the Dushanbe plant (wet method) is also significantly higher than at dry-method plants.

The data presented indicate first of all unsatisfactory operation of equipment at the Dushanbe plant and a lack of supervision of operation of the republic's only cement plant by the Tadzhik SSR Ministry of Construction Materials.

Comparative data on workplace dust at cement plants could be the basis for serious conclusions as to equipment operation standards and for taking immediate steps to improve this work by the republic main administrations and ministry of construction materials.

Dust contains considerable amounts of particles of at least 5 (Table 2), which possess a high penetrating ability, as well as free SiO_2 (Table 3).

Table 2.

(1)	(2)	(3)			(4)	
		(5)	(6)	(7)	(8)	(9)	(10)
(11)							
(12)							
(13)							
(14)							
(15)							
(16)							
(17)							
(18)							
	(19)						
	(20)						

Key:

1. Air sample taken from
2. Dust content of particles of at least 5 , in percent
3. Wet method of production, by plant
4. Dry method of production, by plant
5. "Proletariy"
6. "Oktyabr'"
7. "Gigant"
8. Dushanbe
9. "Pervomayskiy"
10. Slantsevskiy
11. Jawbreaker unloading point

[continued on following page]

Key [to Table 2, preceding page, continued:]

12. Point where raw material is switched from one conveyor to another
13. Furnace control panel room
14. Furnace ports
15. Cement mill control panel room
16. Place where cement mills are charged
17. Place where cement mills discharge
18. Clamshell crane cab:
19. Raw material yard
20. Clinker yard

Table 3.

(1) Места отбора проб воздуха	(2) Содержание в пыли свободной SiO_2, %					
	(3) при мокром способе производства по заводам				(4) при сухом способе производства по заводам	
	(5) «Пролетарий»	(6) «Октябрь»	(7) «Гигант»	(8) Душанбинский	(9) «Первомайский»	(10) Сланцевский
(11) Узел разгрузки щековой дробилки	8,20	6,80	—	3,47	6,9	—
(12) Узел загрузки сырьевых мельниц	—	6,95	5,35	—	8,9	2,8
(13) Помещение комплекса электрофильтров печей	2,90	—	—	—	2,7	—
(14) Узел загрузки цементных мельниц	6,20	11,11	—	7,03	10,6	6,5
(15) Узел разгрузки цементных мельниц	6,71	5,55	7,50	4,21	6,5	—

Key:

1. Air sample taken from
2. Free SiO_2 content, in percent
3. Wet method of production, by plant
4. Dry method of production, by plant
5. "Proletariy"
6. "Oktyabr'"
7. "Gigant"
8. Dushanbe
9. "Pervomayskiy"
10. Slantsevskiy
11. Jawbreaker unloading point
12. Raw material mill loading point
13. Furnace electrostatic precipitator mesh shut-off premises
14. Cement mill loading point
15. Cement mill unloading point

Dust in workplace air at cement plants can be effectively reduced by:

choosing an efficient ventilation plan which considers production technology;

planning aspiration systems with consideration of the physical and chemical properties of the dust;

increasing the technical reliability of dust-cleaning equipment;

introducing optimum aspiration installation operating routines (a good seal is a necessary condition for their normal operation);

use of balanced ventilation, as well as mechanized, centralized dust cleaning and wet mopping of floors and equipment to remove dust that has settled;

sealing technological equipment as well as possible (in the primary crushing section, the chain feed hood covering the place where material from the chain feed moves onto the conveyor should be aspirated, as should the apron conveyors and discharge hoppers receiving material from the conveyor and the crusher drives in the secondary crushing section); to completely eliminate dust generation in the crushing departments, we must introduce a two-stage aspiration air cleaning system using NIIOgaz [State Scientific Research Institute for Gas Purification in Industry and Sanitation] dust extractors, wet dust removal apparatus (in heated premises) and sleeve filters (in unheated premises).

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ANGARSK CEMENT PLANT LEADS INDUSTRY IN ANTI-POLLUTION EFFORTS

Leningrad TSEMENT in Russian No 4 1979 pp 2-3

[Article by Honored Builder of the RSFSR B. I. Kuznetsov, Director of the Angarsk Cement Mining Combine, and Chief Engineer A. N. Lausayev: "Multiple Solutions to Air Quality Problems"]

[Excerpts] The CPSU Central Committee and USSR Council of Ministers Decree "On Additional Steps to Strengthen Environmental Protection and Improve Natural Resources Use" points out that: "Protecting the environment and using natural resources intelligently given the rapid development of industry, transport and agriculture and the involvement of increasing amounts of natural resources in production is one of the most important economic and social tasks of the Soviet state."

The collective of the Angarsk Cement Mining Combine has accumulated a great deal of experience in the overall solution of the problem of protecting the environment and workers' health in combination with successful utilization of the enterprise's designed capacities and with labor productivity growth.

Our enterprise is the only one in the branch where cement is produced from other than ductile raw material. We use marbelized, high-magnesia limestone, with rock from coal mine dumps as the clay component, and TETs cinders and gas-generator production wastes as the slag; high-ash Cheremkhovo coal is used as fuel.

The usual dust and gas scrubber technology and devices were the basis of the plant design drawn up by the Giprotsement. When the first technological lines were put on-line, nonreturn dust generation reached 30 percent of the dry raw material with which the furnace was charged. During roasting, the slurry quickly gave off moisture, was not granulated, and was transformed into finely-dispersed dust. The electrostatic precipitators were unable to clean the dust highly concentrated in the exhaust gases, so it reached the atmosphere.

When the rotary furnaces were put into operation, the collective was faced with difficulties associated with the necessity of protecting the atmosphere

from pollution, with increasing its responsibility for carrying out the measures outlined in this area.

Using the experience of leading plants and in cooperation with specialists from the Giprotsement [All-Union State Scientific Research and Planning Institute of the Cement Industry], NIItsement [State All-Union Scientific Research Institute of the Cement Industry] and Orgproyekttsement [All-Union State Special Office for Starting, Adjustment, Planning and Design Work in the Cement Industry], steps were taken during the initial years of enterprise operation which enabled us to reduce nonreturn dust generation severalfold and make the plant profitable. This created within the collective a confidence that the plant could be transformed into an enterprise with high standards.

We began equipping the shops and landscaping according to a Giprotsement plan.

A special laboratory was set up to record dust and gas discharges, the condition of the air near the plant site and in the sanitary zone was constantly monitored, and a scientific-technical council was created to solve problems associated with protecting the air and coordinating work in this particular area. Chemical engineers and laboratory assistants received special training and armed themselves with the skills necessary to correctly resolve tasks in the field of environmental protection. A program of industrial-sanitation laboratory work was developed with the assistance of the city sanitary-epidemiological service.

After a careful analysis of the results of a check made by the laboratory in 1970-1975 of the scrubbers' effectiveness, a complex of measures was carried out to reduce air and water pollution:

heat-exchange installations were improved and the rotary furnace thermotechnical routine was stabilized, which reduced the dust load on the electrostatic precipitators;

regular preventive maintenance was done on the electrostatic precipitators; ATF and AUF step-up transformer/rectifier units were introduced; individual electrode grounds were installed;

the entire plant site was landscaped.

As a result, dust discharges were reduced to sanitary norms, and nonreturn dust generation and dust in the sanitary zone were substantially reduced.

The closed water supply system put into operation enabled us to avoid discharging any industrial wastes into the Angara.

These successes did not go unnoticed. The combine was awarded the title of "Collective of High Production Standards" and two years later it became a "Collective of Communist Labor."

Simultaneously with the implementation of those environmental protection measures, the 3.6/3.3/3.6 X 150 m rotary furnaces were modernized by increasing

their diameter; stock mills were renovated; a manganese steel combined self-sorting armored lining was used in the first mill chamber and a rubber lining in the second and third chambers. Rods and "tail'pebs" are used as the grinding substances. Slurry moisture content has been reduced to 31 percent.

The armor plate is secured without bolts in the cement mills, and the babbit journal bearings have been replaced by bearings of a wood-laminate plastic.

The impact of our combining environmental protection measures with concern for retooling the enterprise is testified to by the table.

indicators	years		
	1965	1970	1978
dust discharge, tons per day	46	30	7.8
cement production, 1,000 tons per year	763.1	941	1,176
average cement quality, kgs/cm^2	300	341.9	415.2
reference fuel expenditure, kg/ton	226	200	196.8
cement prime cost, rubles/ton	14.37	13.66	13.25
lining life, days	93	200	350
rotary furnace productivity, tons/hour	22	24.8	30.4
profit on sales, million rubles	1.45	4.67	9.39
industrial-production personnel, in percent of 1965	100	76	66

The data given in the table demonstrate convincingly that successful resolution of environmental protection tasks has facilitated production growth and improvement in cement quality and enterprise technical-economic indicators. In 1978, designed capacity was exceeded by 30 percent. The collective's persistent work, its experience, the growing cooperation with branch institutes and the widespread socialist competition are guarantees that we will increase cement production to 1.3 to 1.4 million tons per year and the production of "500" cement to 50-60 percent of the total volume produced.

To do this, work must be continued through 1981-1985 on production retooling and the following measures implemented:

replacement of obsolete and obsolescent imported electrostatic precipitators and sleeve filters with highly efficient, domestically produced ones: UGZ-3x88, UV-1-16, SMTs-101, SMTs-166; up-dating inefficient dust-generating crushing, grinding and transport equipment by installing more efficient equipment which does not generate dust;

using slurry manufactured from TETs cinders and waste water in production rather than the clean Angara water now being used in slurry production.

These steps are already being taken. In 1978, UGZ-3x88 electrostatic precipitators were put into operation for the first time in the branch. The high efficiency of exhaust gas cleaning achieved confirms the possibility of increasing the hourly productivity of the rotary furnaces by further modernizing them by increasing their diameter and their speed of rotation to 1.8 rpm.

When the UGZ-3x88 filter was built, started up and adjusted, the precipitation electrode elements were discovered to be insecurely clamped. The electrostatic precipitator supplier plant had to eliminate the deficiency: the vibrating mechanisms were replaced with more reliable reductors; agitation of the precipitation electrode elements was eliminated and they were made more secure.

A reserve self-supporting filter has been designed for routine replacement of existing filters without stopping the rotary furnaces. Renovation of the scrubber for rotating furnaces Nos 1-4 will enable us to increase clinker production by 60-70 percent over the planned level.

Introduction of a closed grinding cycle for 2.6x13 m mills will provide an opportunity for processing an ever-increasing amount of clinker into cement. At the same time, the existing "Lurga" vertical filters will not be able to remove all the dust from the increasing amount of cement mill aspiration air. It is being proposed that domestic vertical filters be installed behind the "Lurga" filters without stopping these mills (the "Lurga" filters then to serve as dust-precipitation chambers). Two such vertical filters are to be installed in 1979.

The final step will be to equip cement silos, packaging machines, loading-unloading sectors and pouring installations with the highly effective SMTs-100 and SMTs-166 filters.

Highly efficient SMTs-166 and SMTs-101 sleeve filters are being installed at the initial crushing factory of the "Pereval" mining enterprise, at loading sectors, at finished product warehouses, and in pouring sections. They are being installed behind NIIOgaz [State Scientific Research Institute for Gas Purification in Industry and Sanitation] precipitation shafts and dust extractors.

The main center of dust generation was the secondary crushing factory. The imported hammer mills installed there generated abundant dust, which the wet dust extraction installations and filters could not cope with. Now, these obsolescent mills are being replaced by highly efficient KSD-2200T conical mills. Installation of just one such mill enabled us to eliminate much of the dust, and another KSD-2200T mill is presently being installed. Putting a third conical mill into operation, but this time a KMD-2200T, will enable us to get rid of all the hammer mills and to reduce the number of operating and maintenance personnel.

Over the past 10 years, the combine has worked the entire cinder dump of the TSTs. It has begun mining and processing the current TSTS marshy cinder dump.

Two years ago, a hydraulic complex to transport the cinder directly to the plant using pumps was built following a VNIIPIstromsyr'ye plan. The cinders are separated from the water using classifiers. The institute requested several years to master the complex. We could not agree to that and demanded

that the institute take decisive steps to create normal cinder mining, transport and processing conditions, but it has not managed to solve this problem.

Our research enabled us to determine conditions under which the hydraulic complex could ensure the ash slurry feed to the raw material mills:

the TETs must reduce discarded cinder moisture content to 90 percent;

three certical continuous-operation 1,500 m^3 sump precipitators must be built at the combine.

The indicated conditions must be actualized. In solving this important problem, we expect help from the USSR Ministry of Construction Materials' Glavvostoktsement [Main Administration of Eastern Regions Cement Industry].

The Angarsk Cement-Mining Combine collective has implemented a broad complex of organizational-technical measures to protect the environment and raise production standards. Its achievements in this field have been repeatedly noted. We are well-aware that concern for the environment is not a transitory campaign, but an everyday concern requiring much effort, energy and initiative.

Other branch enterprises also have experience in this. It must be made accessible to the entire cement industry, and the work begun must be continued on an ever-growing scale, in combination with steps to increase cement production, improve its quality, and achieve greater economy. In so doing, we will make an important contribution to carrying out party and government decisions on protecting the environment and improving natural resources use.

> Cement production specifics obligate branch workers to pay priority attention to protecting the environment. Unfortunately, there is no other cement industry enterprise fighting so persistently and purposefully to protect the environment as is the Angarsk Cement-Mining Combine. It is especially important that this task be resolved by the Angarsk cement workers in an overall fashion, as an integral part of the collective's socio-economic development plan. Such an approach ensures that the enterprise will achieve high technical-economic indicators and continued success in socialist competition. We consider it appropriate to hold an all-union seminar at the Angarsk combine to generalize leading branch enterprise environmental protection work experience and that recommendations be worked out in this area. In publishing this article by Angarsk Cement-Mining Combine leaders on environmental protection work, the editors call on branch workers to copy extensively the experience of the Angarsk cement workers.

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